But had those flowers which late thy brow adorn'd,
Bloom'd near thy heart, love had not then been scorn'd;
Thy flutt'ring pulse had own'd his sovereign power,
And love had reign'd and revell'd out his hour:
For know that plants congenial joys can prove,
And flowers themselves bow down to potent love:
That mimic transport every leaflet shakes,
And love's soft light on vegetation breaks:
All nature owns his ruling sway divine,
And flowers with flowers their gentle hearts entwine.
Hence learn, that love or fortune's gifts misplac'd,
Or wound the head or heart they might have grac'd:
That minds, like flowers ill-sorted, still must smart,
And rankling care assail the aching heart,
And tho' th' unruffl'd brow oft smiles adorn,
The throbbing bosom feels a goading thorn.

DISCOVERIES AND IMPROVEMENTS IN ARTS, MANUFACTURES, AND AGRICULTURE.

Extracts from an Essay, No. 16, *on the Management of Light in Illumination; by Benjamin Count of Rumford, F.R.S.*

(Continued from last Number, page 306.)

Description of a Portable Lamp.

As vegetable oils, purified by means of the sulphuric acid, burn without either smoke or smell, and give a great abundance of pure white light in their combustion, and as they cost considerably less than tallow, by the pound, and give more light, great advantages would be derived from the general use of them for domestic illumination: but to render this possible, lamps must be made portable. As they have hitherto been constructed, the danger of spilling the oil is so great, and that accident is so very disagreeable, that nobody who can avoid it, will make use of them, except in cases where they can be stationary: where a light is wanted that must be continually moved about from place to place, candles are universally preferred, though many inconveniences attend the use of them.

Perceiving that great advantages could not fail to be derived from the introduction of a good portable lamp, for common use, to supply the place of tallow candles, I have taken a good deal of pains to contrive such a lamp; and after many experiments, I have at length succeeded in this undertaking

This lamp, which is not inelegant in its appearance, is liable to none of those disagreeable accidents to which lamps in general are exposed. It is so perfectly neat and cleanly that it never spills a drop of oil, nor even lets it come into view; and when properly arranged it never smokes or diffuses any disagreeable smell, not even when it is extinguished. Its flame being covered and protected by its glass chimney, burns so steadily that it is not in the least deranged, either by the wind, or in being moved about from place to place; and the flame of this lamp is so immovably fixed in the axis of its chimney, by the ascending current of air, that it does not quit it, even when the chimney is considerably inclined, so that the flame very seldom touches the glass.

This lamp has one quality which no other ever possessed before in the same perfection: it may be made to furnish any quantity of light required, from that of the smallest bed-chamber lamp or feeblest taper, to that furnished by three or four candles, all burning together: and these alternate variations in the quantities of of light emitted by it, may be repeated at pleasure, without any trouble, merely by turning a button which moves a rack that is concealed in the body of the lamp, or rather, in the column on which it is placed.

I shall first endeavour to give an idea of the general form of this lamp; and shall then proceed to describe its various parts more particularly.

The end of the burner appears above the circular reservoir, and its flame is confined in the glass chimney.

The vertical tube is the stand which supports the lamp; it has a circular foot, and it ends above at the moulding, which belongs to it, and forms what may be considered as its brim. Into the opening of the tube, the lower extremity of the tube enters at about one inch and it is firmly fixed in it by means of a contrivance similar to that used for fixing a bayonet to its musket.

About one inch and a half above the lower extremity of the tube, this tube is perforated by a circular row of air holes, which goes quite round it. These holes are concealed by the hoop, which is fastened to the tube, by means of three vertical projections, made of pieces of wire, soldered to the tube, at equal distances from each other. The hoop being afterwards soldered to the ends of these wires, it is supported by them in its place, and the air passing between the inside of the hoop and the outside of the tube, enters the air-holes.

The use of this hoop is to screen the air-holes, and prevent the flame of the lamp from being disturbed by sudden gusts of wind.

A button is used for moving a rack, (concealed in the inside of the tube,) which serves for elevating and lowering the wick.

The glass chimney is placed in the upper part of the tube, and in order that it may be firmly fixed in its place, an elastic hoop, made of tin, covered on both sides with soft leather, is first pushed down into the opening of the tube, and the lower extremity of the glass chimney is forced down into this hoop. This hoop is one inch wide, and when it is in its place, it rests on the tubes. The hoop of tin is not soldered together, and in order to render it more elastic, it has a number of vertical slits, which extend from the upper side of the hoop to within one quarter of an inch of the lower side of it.

This hoop, covered on both sides with soft leather, (such as is used for making ladies' gloves,) is about one-tenth of an inch in thickness, so that its diameter within is one inch and three-tenths, which is also the diameter of the glass chimnies below, or of that portion of it which enters the hoop.

The circular reservoir is composed of two pieces of tin, formed under the hammer, which are soldered to each other, and to the tube. That which forms the upper part of the reservoir is convex, the other is in the form of the large end of a trumpet.

The oil passes from this reservior into the burner through a very small hole made in the side of the tube, which opens into the interior of the short tube.

The hoop, which serves as a screen to the air-holes in the tube, is three-fourths of an inch in width, and 1.7 inches in diameter.

Before this hoop was used, the flame of the lamp was liable to be deranged, not only by sudden blasts of wind, blowing directly into these air-holes, but also by sudden jerks accidentally given to the lamp in carrying it; but the hoop has been found to be an effectual security against both these accidents.

The rings, which have the appearance of being introduced for mere ornament, serve for two important purposes; they prevent the air from being forced into the air-holes in such a manner as to derange the flame in moving the lamp very suddenly, or with a jerk, either upwards or downwards; and they also prevent the air within the tube from passing too freely out of it, by a retrograde motion on every puff of wind that may blow down into the glass chimney.

In order more effectually to defend this lamp against those descending blasts, and also from being blown out by the air forced into the opening of the chimney above, on lifting up the lamp very suddenly, the top of the chimney is covered by a small conical roof, made of thin sheet-iron, two inches in diameter below, and about one inch and a quarter in height. This roof is fixed in its place by means of three narrow vertical slips of sheet-iron, a quarter of an inch in width, and an inch and a half in length, which are rivetted above to the inside of the conical roof. These slips, which are elastic, on being forced together, enter the glass chimney, and by pressing against its sides, keep the roof fixed in its place.

It might have been apprehended, that this roof would have so checked the ascending current of air in the chimney, as to diminish the rapidity of the combustion, and impair the brilliancy of the light; but this has not been found to be the case. The three slips of sheet-iron, by which the roof is fixed in its place, are so arranged, that the level of the lower part of the roof is about one tenth of an inch higher than

the extremity of the glass chimney; and a greater height has not been found to be necessary to give a free passage to the air.

These different contrivances defend the lamp so effectually against both wind and rain, that the lamp may, without any risque, be used in the open air instead of a lantern, and even in stormy weather.

The use of the roof is not absolutely necessary within doors; but when the lamp is exposed to the wind in the open air, it will stand in need of its protection; and it is also very useful when the lamp is carried about from place to place, to prevent its being extinguished by sudden jerks.

I shall now endeavour to describe a very essential part of this lamp, and one which, more than any other, distinguishes it from all other lamps; this is its *secondary reservoir.*

This is a rectangular flat tube, which projects horizontally from one side of the circular reservoir already described. It is 1.25 in width, 0.8 of an inch in depth, and 6 inches in length, and it is closed at its farther end. It serves at the same time as a secondary reservoir, and as a handle for holding the lamp when it is carried about from place to place; instead of being made of a prismatic form, it is frequently swelled out at its sides, and rounded off at its extremity (farthest from the lamp); and it is always painted black, and japanned. This is done in order to give it the appearance of being merely a handle.

It is on the upper part of this secondary reservoir, where it projects horizontally over the upper part of the circular reservoir, that the opening is placed, by which this lamp is filled with oil, and this opening is closed by a perforated brass stopper, on which a hollow cone is placed, that serves to give a passage to the air which enters the reservoir.

In order to show, in a clear and satisfactory manner, the various objects had in view in the contrivance of this machinery, (if any thing can be called machinery which produces its effect without any motion of its parts,) we will suppose the lamp first to be filled with oil, and then lighted.

The oil passing continually through the small opening in the side of the cylinder, will flow through the tube into the burner.

As the oil in the circular reservoir passes freely into the burner, so that, in the secondary reservoir, passes freely into the circular reservoir, through the small square trunk, open at both ends, which is fixed down on the bottom of the secondary reservoir; so that the lamp will continue to burn till the last drop of oil is consumed.

It is very certain that the oil in the secondary reservoir would not flow freely out of it into the circular reservoir, if air could not at the same time enter it freely to replace that oil: but the long square tube, fixed to the top of the secondary reservoir, gives a free passage to the air from one of the reservoirs to the other; and as the stoppers which closes the opening by which the oil is poured into the lamp, is perforated at the point of its double cone, with a hole sufficiently large to establish the necessary communication between the air in the circular reservoir, and that of the surrounding atmosphere, there is nothing in any of these contrivances that can prevent the lamp from burning well, and consuming the whole of its oil.

Suppose now, that the lamp, properly arranged, and burning well, be taken up by its handle, and carried about from place to place in the open air. As it cannot be supposed, that those into whose hands this lamp must fall, if it ever gets into general use, will have leisure to pay much attention to their manner of holding it, in carrying it about, in the course of their business; if the lamp does not take care of itself, it can be of no real value: but a bare inspection will be sufficient to show, that it cannot be liable to any of those accidents which have hitherto prevented lamps from being portable.

The very small quantity of oil that can be contained in the vertical burner, cannot be thrown out of it by any sudden jolts the lamp may receive in being carried in the hand, or on being suddenly set down; and the concussions which the oil in the circular reservoir may receive, cannot sensibly affect that in the burner: that accident has been effectually guarded against, by causing the oil to pass through a very small hole in its way from the circular reservoir to the burner.

As this small hole is made in the side of a tube which is vertical, it is not liable to be stopped up by bubbles of air, nor by the sediment of the oil; and if it should ever happen to be stopped up by any accident, it can easily be cleared out by means of a small wire, introduced by the opening through which the lamp is filled with oil.

Notwithstanding the smallness of the opening by which the oil passes into the burner, if, from carelessness in carrying the lamp, it were held for a considerable time in such a manner that the extremity of the handle were considerably higher than the level of the top of the burner, so much oil might at length have been forced into the burner as to overflow; but this accident is prevented by the vertical partition which separates the cavities of the two reservoirs. As long as the lamp stands on its foot, or is carried in such a manner that its burner is held in a vertical position, the oil flows freely from one reservoir to the other, as we have just seen; but as soon as the lamp is leaned forward in such a manner as to cause the end of its handle farthest from the burner, to be raised up higher than the top of the burner, the oil in the cavity of the handle is thrown forward against the vertical partition, which partition will support this oil, and prevent its descending into the circular reservoir. The small quantity of oil contained in the lower square trunk, belonging to the secondary reservoir, may descend into the circular reservoir, but no more of the oil in this reservoir can follow it, for the farther end of that tube, and also of the air-tube, will now be elevated above the surface of that oil.

These contrivances effectually prevent the oil from overflowing at the extremity of the burner; but others were necessary to prevents its being thrown out of the lamp by the opening, which it was necessary to leave for the air to pass freely in and out of the reservoir. The most convenient situation for this opening is in the middle of the stopper, which closes the passage by which the oil is poured into the lamp; and there I have established it. This stopper is perforated at its center by a vertical hole of about one-tenth of an inch in diameter, and on the top of this stopper, which is flat, there is soldered a thin hollow truncated cone, made of tin, half an inch in diameter below, 0.1 of an inch in diameter above, and three-fourths of an inch in height, in the axis of which another smaller truncated cone is placed in such a manner as to remain suspended in it. This smaller cone is 0.15 of an inch in diameter below, 0.5 of an inch in diameter above, and half an inch in height, and it is entirely concealed in the larger cone, except only about 0.1 of an inch in length of its upper end, which comes through the small opening of the larger cone to which it is soldered.

This simple contrivance has proved to be an effectual remedy for an accident which embarrassed me for some time. When the lamp happens to receive any violent jolt, the regurgitation of the oil in the circular reservoir is sometimes such as to cause a small portion of oil to be thrown up through the small hole left for the passage of the air, in the centre of the brass stopper, and although I had taken the precaution to cover this opening by a vertical narrow tube, near an inch long, the oil was, nevertheless, sometimes forced out of the top of this tube, by the air which escaped from the secondary reservoir, on its being warmed by the hand; but since I have substituted the double cone in lieu of this vertical tube, this accident has never happened; and a bare inspection is sufficient to show that it never can happen.

Any small quantity of oil on being thrown up into the conical chamber, must necessarily spread over the bottom of it, from whence it will afterwards descend slowly, and the air that may happen to follow it immediately into the conical chamber, will pass through it, and escape by the small interior cone, which is evidently out of the reach of the oil, and therefore cannot be soiled by it.

As the brass tube which forms the opening by which the oil is poured into the lamp, descends about a quarter of an inch below the level of the upper part of the circular reservoirs, it is evident, that this reservoir cannot be completely filled with oil, for the air cannot all escape out of it. It would have been easy, by piercing this tube on the side of the circular reservoir, in the same manner as it is pierced on the opposite side (to facilitate the escape of the air out of the secondary reservoir), to have opened a passage for the escape of all the air out of the circular reservoir; but I have not done it, for I conceived that it might be advantageous to leave some air in the circular reservoir, which, on inclining the lamp forward, escapes, and makes room for the oil which runs out of the trunk of the secondary reservoir, when the lamp is so inclined.

This precaution could never be of any use, except when the lamp, after having been entirely filled with oil, and before any sensible quantity of it should have been consumed, should be so much and so long inclined as to endanger the overflowing of the oil in the burner, by the pressure of that in the trunk; and although

this accident could seldom have happened, yet I was very glad to have found means to prevent it; its effects indeed in no case could have been found very disagreeable, for as all the oil that could possibly have overflowed at the extremity of the burner must necessarily have run down on the outside of it, and fallen into the reservoir in the foot of the lamp, it could never have been seen, and much less have been spilled in such a manner as to run out of the lamp: that is an accident which I conceive to be quite impossible to happen with this lamp; and such is my security on that head, that I frequently take a portable lamp, filled with oil, with me in my carriage, when I travel, and place it, and not always perfectly upright, in one of the pockets, not lighted to be sure! but ready to light when I arrive at an inn where I mean to spend the night. It is true, that in these cases I always take care to draw back the wick, and to close the opening of the burner with a fit stopper, but the opening by which the air enters the reservoir is never closed.

The burners of these portable lamps have been made of various forms; and wicks of different kinds have been employed. As it will always be necessary to wear glass chimnies with these lamps, in order to prevent their flames from being deranged from the wind, such forms must be chosen which will render the operation of trimming the lamp as easy as possible. A flat wick is the easiest trimmed, but that form is not well adapted to a cylindrical glass chimney, neither is it favourable to the production of light.

A small cylindrical wick, similar to those used in Argand's lamp, gives a great deal of very pure white light; but as it requires a current of air in the axis of it, in order to its performing well, this renders the construction of the burner too complicated, and the operation of changing the wick, and trimming it, too delicate and difficult for common use. It is, however, most certain, that this wick produces a very striking and beautiful effect, and many persons have preferred it to all others.

The wick which has answered best for general use, is a flat ribband wick about one inch wide, prepared by dipping it into very hot tallow; which, when cooled, and cut into proper lengths, is laid by for use. When a new wick is wanted, one of these flat wicks is moulded on a wooden cylinder of about 0.3 of an inch in diameter, and made to take the form of tube open on one side, from end to end; and in that form it enters the burner, which is so constructed as to receive it, and also to preserve its form till it is quite consumed.

The form of the burner is such, that a horizontal section of it is nearly in the shape of a horse-shoe, the open part of it being turned towards the handle of the lamp.

To move the wick, a contrivance has been used, which is not a new invention, but which has been found to be very useful. A strong cylindrical rod, of stout wire, a little more than one-tenth of an inch in diameter, passing vertically through a collar, formed of several pieces of leather, confined in a small cylindrical brass box soldered to the burner, enter the burner at the bottom of it, and being fixed at its lower extremity to the lower end of a rack which is placed vertically by the side of the burner, and which is moved by means of a pinion, connected with a button, placed on the outside of the vertical tube, which conceals both the burner and the rack, by turning this button to the right or to the left, the cylindrical rod is moved either up or down, in the burner, as the occasion may require.

To the upper end of this cylindrical rod is fixed a pair of small elastic nippers, with sharp teeth, which hold the lower end of the wick. As long as these nippers are within the burner, they are so pressed together by its two opposite sides that they hold the wick very fast, but when they are pushed up so high as to come out of the burner, they separate from each other, in consequence of their elasticity.

When they are in this situation the remains of the old wick may be removed without difficulty, and the end of the new wick being put in their place, on causing the nippers to descend into the burner, they will necessarily draw the new wick after them.

The changing of the wick of a lamp has hitherto been a very disagreeable and filthy operation, but from this description it is evident the wick of this lamp may be changed in an instant, and that there is nothing either difficult or disgusting in that momentary process.

Care must be taken in trimming the new wick, first, to make it descend as far as possible into the burner; then to cut off with a pair of sharp scissars all that projects above the level of the top of the

burner: and when this has been done, the wick must be raised about 1.20 of an inch, and again cut off level with the top of the burner; if this precaution be neglected, the wick will be too long to be extinguished suddenly, and without smoke, after having been lighted for the first time; if attention be paid to it, no disagreeable smell whatever will be diffused on that occasion, nor on any other.

All the lamps with which I am acquainted, diffuse a very noxious stinking vapour, when they are made to burn with a very small flame. Even an Argand lamp, in which the combustion of the oil is usually so complete, if it be so arranged by lowering its wick as to give only about one-sixth part of the light it usually furnishes, it will diffuse a smell so very offensive, that it will become quite insupportable.

To see clearly into this matter, we have only to consider what the changes are which take place when an Argand lamp, burning with its usual vivacity, is suddenly made to burn with a very feeble flame.

When this lamp burns well, the current of air which passes upwards through its chimney is so strong, that the flame of the lamp is forced upwards towards the upper end of the wick; and the burner being at some distance from the flame, is kept so cool by this strong blast of cold air, that it does not become sufficiently hot to decompose the oil with which it is always in contact; but as soon as the wick is considerably shortened, the flame being much diminished, the current of air through the chimney becomes very feeble, and the flame being no longer forced upwards by that current, descends by degrees, till at last it establishes itself on the very brim of the burner. This necessarily heats the top of the burner very hot, however small the flame may be; and as all the oils which are used in lamps are decomposed and evaporated at a lower temperature than that at which they take fire and burn, the cause of the offensive vapour which is diffused by lamps with metallic burners, when they are made to burn with very small flames, is quite evident.

Conceiving that the evil might be remedied by preventing the flame from coming into contact with the burner, I attempted to do this by giving to the burner a projecting brim, in the form of an inverted truncated cone, and about one-tenth of an inch in width; and this contrivance has completely answered the purpose for which it was designed. As the current of air which keeps the flame alive passes upwards in the chimney, it is thrown outwards by the projecting brim of the burner, from whence it returns and falls into the flame in an oblique direction; which prevents the flame from descending so low as to come into contact with the burner.

Since this improvement has been introduced in the construction of the burners of the portable lamps, they have ceased to diffuse a disagreeable smell, on being made to burn with a very small flame; and they are now frequently employed as night-lamps, (veilleuses) in bed-rooms.

They are better adapted for that use as they are not liable to be deranged by the wind, or by any other accident, and can always be made to give a very bright light, in a moment, as often as such a light is wanted, during the night.

For those who have the bad habit of reading in bed, they will be very convenient, and much less dangerous than candles, or common lamps. They will likewise be found to be very useful in anti-rooms in great houses, where several of them may be lighted and kept constantly burning with reduced flames, for a very small expense; and at the moment when they are wanted they may be made to furnish their usual quantity of light, and when they are brought back into the anti-room, their flames may again be reduced. They would cost much less than wax-tapers, or bougies; and would be much more cleanly and agreeable.

As the light emitted by these lamps is exceedingly vivid, and especially when they are made to burn with their greatest brilliancy, their flames should always be masked by screens, made of ground glass, or of white gauze or crape. The most simple and best form for a screen for this lamp is that of a truncated cone, six inches in diameter at its base; one inch and a half in diameter above, and three and a quarter in perpendicular height; with a gallery above, of about half an inch in height, made of tin japanned, to serve instead of a handle in placing it and removing it. This screen may be fixed in its place by means of a conical tube of tin, attached to the screen on the inside of it, which may be made to receive the cone which is fixed to the stopper which closes the opening by which the lamp is filled with oil.

The handle of the lamp being six inches in length, enough of it will project beyond

the lower part of this screen to give a sufficient hold of it in carrying the lamp.

A small balloon screen, of about six inches in diameter, is frequently used with this lamp, and has a very fine effect. This balloon is made of white crape, fixed to vertical ribs of covered wire, and has an opening below of about 2.4 inches in diameter, that it may rest on the widest part of the circular reservoir, and it has also a circular opening above one inch and a half in diameter to give a passage to the upper end of the glass chimney. This opening at the upper part of the balloon should be surrounded by a gallery of tin, japanned, similar to that on the top of the conical screen, and for the same use.

This balloon screen must also have another opening below, on one side, to make way for the projecting handle of the lamp. The best way of fixing this screen in its place, is by means of a conical tube, fastened to it on the inside of it, in the same manner as the conical screen is fixed.

When this lamp is used as a bedchamber lamp, and made to burn with a very small flame, its feeble light may be almost entirely concealed by placing a conical screen, made of pasteboard, over its conical screen of gauze or crape.

Though the principal merit of this lamp is its being portable, yet, as it is not liable to spilling its oil, and gives a clear bright light, without either smoke or smell, it is perfectly well calculated to serve as a table lamp, even in elegant apartments, and also for lighting dining-tables; but when it is intended to be used for these purposes, it should be placed on a stand, sufficiently elevated to raise its flame to the height of 12 or 15 inches. This additional height does not prevent its being portable; but when it is lower, it appears to be better adapted for being carried about in the hand. It must however be made about nine inches in height, otherwise there will not be room for the rack to descend sufficiently low to allow of a wick being used of a reasonable length.

Many attempts have been made to improve the light of lamps by preparing their wick; and prepared wicks have been sold at high prices; but the secret of their preparation has not to my knowledge been made public.

Having purchased some of these prepared wicks several years ago at Munich, from an itinerant Italian pedlar, I analysed them: on exposing them to heat, I separated from them a substance which had every appearance of being pure tallow, but to which a strong and not disagreeable scent had been given, probably to conceal the secret of the preparation, which I then considered as being a mere cheat, and paid no farther attention to it. Some time after, on considering the matter attentively, I found reason to conclude that either tallow or wax, heated very hot, might very probably be used with advantage for preparing wicks for lamps, and also for candles. I can explain my ideas on that subject in a very few words.

In order that a lamp or candle may burn well, it is necessary that the oil, tallow, or wax, which supplies the combustion, should *flow freely* over the surface of those minute fibres of the cotton which compose the wick.

Every extraneous body, whether solid or fluid, which remains attached to the surface of those fibres, must necessarily prevent the oil, tallow, &c. from flowing freely over them.

Now it is most certain that a considerable quantity of air, and also of water, (moisture,) remains attached to the cotton wicks of lamps for a long time after they have been immersed in oil. This may easily be made to appear by exposing the oil with the wick in it, under the exhausted receiver of an air-pump: for the surface of the cotton will be quite covered with small bubbles of air in a few minutes; or if the wick of a lamp full of oil, or of a candle full of tallow, or of wax, be thrown into melted tallow, so heated as to be almost ready to boil, as this heat is considerably greater than that at which water boils, not only the air, but the moisture also, which remains attached to the cotton, will be suddenly driven out of it. This will occasion a violent effervescence, accompanied by a loud hissing, which, however, will cease entirely in a few moments, and the cotton will sink down to the bottom of the hot melted tallow, where it will remain perfectly quiet, and free from air bubbles.

These appearances afford a decisive proof that air or moisture, or both, remain attached to the wicks of lamps and candles; and it is most certain that they must necessarily be injurious to the wick, by preventing the oil, melted tallow, or melted wax, from flowing freely over the

minute fibres of the cotton. But this experiment shows us at the same time how this evil may be effectually prevented.

By heating melted tallow till it is nearly boiling hot, on throwing into this hot liquid a parcel of clean dry wicks, the air and the moisture will be expelled in a few moments, with a hissing noise, and being replaced by the tallow, they will be permanently excluded. As soon as the hissing has ceased, the wicks may be taken out of the melted tallow to drip and cool, and when cold, they may be cut into proper lengths, and being wrapped up in clean paper, to preserve them from the dust, they may be preserved for years without change.

The wicks of tallow candles and of wax candles might be prepared by dipping them for *the first time* in melted tallow or melted wax, heated *very hot*, in order more effectually to expel the air and moisture.

Wicks for lamps may be prepared by immersing them in hot melted wax, instead of using melted tallow for that purpose; and many persons who manage their lamps themselves, would, no doubt, prefer wax, on account of its greater cleanliness; but having tried both these substances, I have not found that the wicks which had been prepared with wax, burned better than those prepared with tallow.

As dust, and in general every species of soil, is very injurious to wick, it is necessary that those which are to be prepared be well washed and dried, before they undergo this operation.

As oils that are purified by means of the sulphuric acid, always retain a certain portion of the acid, notwithstanding all the pains that are taken to separate and remove it, if that residue of the acid attacks the wick and injures it, so as to spoil it entirely, if left for a considerable time in the oil, as is generally supposed, as either the tallow or the wax used in preparing the wick will effectually preserve the cotton from the acid, till it shall have been displaced by the oil, on being melted in consequence of the lamp being lighted; it is evident that this mode of preparation must be useful as a preservative against the attacks of the acid, especially when a lamp filled with oil remains some time without being lighted.

The corrosive effects of this acid is so injurious to the burner, especially at its extremity, where the heat is considerable, that the burner of an Argand lamp seldom lasts more than two years. To remedy this evil, I have lately given directions for the upper end of the burner (about half an inch in length), to be made of silver, instead of tin or copper; and as this alteration does not occasion an additional expense of more than eighteen pence or two shillings, it must in the end turn out to be very economical. All lamps with vertical burners should be constructed in this manner, especially when they are destined to be used with purified oil.

Before I finish my account of this portable lamp, I must say a few words more respecting the different forms that may be given to its wick.

As the internal diameter of the glass chimney of this lamp, at the level of the lower part of the flame, must not be more than eight-tenths of an inch, it is necessary that the flame should be placed as exactly as possible in the middle of it, for otherwise there will be some danger of its touching the glass. To avoid that accident, wider chimnies have sometimes been used; but where this has been done, the beautiful white colour of the flame has always been more or less injured, and the quantity of light sensibly diminished; in short, the combustion of the oil has been rendered incomplete.

Those who have attended to the striking effect produced by blowing wood fire with a bellows, in whitening the flame and increasing the light, will easily conceive how much the beauty of the flame of a lamp must depend on the manner in which the air is introduced which supplies the combustion.

The glass chimney of Argand's lamp is useful, no doubt, in defending the flame, and preventing its being agitated by the wind; but it is its usefulness as a blower which renders this contrivance so highly interesting.

I have lately made several experiments with braided wicks, in the form of round whip-cords, which have produced a great deal of very pure white light; and I am almost inclined to think that these wicks will be preferable to all others for portable lamps, and perhaps for table lamps also, where not more light is wanted than is emitted by three or four candles.

These cord wicks should be about two-tenths of an inch in diameter; and to stiffen them, they should be braided round a very small cylinder of wood, of about one-twentieth of an inch in diameter, or round

a small slip of cane. This wood, which will be concealed in the middle of the wick, will not only be useful to support that part of the wick which is on fire, but it will also be very useful to prevent the ascent of the oil in the centre of the wick, which will render it possible to use cord-wicks of larger diameter than could otherwise be used without danger of causing the lamp to smoke.

When cord-wicks are employed, three of them must always be used together; and they must be fastened together at their lower extremities, by binding them with a strong thread, to receive them: the burner must of course be cylindrical, and its diameter must be such as just to receive the three cord-wicks without pressing them so as to change their form: this burner must have a rim about one-tenth of an inch in width projecting outwards, and obliquely upwards at its upper extremity: and care should be taken to clean this rim every time the lamp is trimmed. The wick being drawn down into the burner by means of the rack, the rim may be cleaned in a moment, with little trouble, *but this must never be neglected.*

These cord-wicks must be previously prepared, by dipping them into melted tallow, or melted wax, *heated very hot;* and it will be useful to draw them (in the same manner as wire is drawn,) through a round smooth hole, made in a thick plate of iron, or of brass, before they become quite cold. This will reduce them to the proper diameter, and will at the same time render them smooth, solid and stiff, and enable them the better to preserve their cylindrical form when they are bound together in bundles (of three,) for use.

It appears to me to be very probable, that a very strong twisted, hard, hempen cord, of about one-twentieth of an inch in diameter, prepared in a solution of allum, would answer perhaps quite as well as wood, for stiffening these cord-sticks, and preventing the oil from rising too freely in the central parts of the cord. There is great reason to suppose, that wicks of this kind would be very useful for tallow candles.

A wick of this form is easily trimmed: its flame is uncommonly beautiful; it may be made to burn well with a moderate light, or to give a great deal of light: the flame occupies the axis of the glass chimney with great steadiness; and the lamp may be made to burn with a very small flame when necessary, without either smoke or smell.

To all these advantages we may add one more, which on some occasions may be very useful; when the burner is cylindrical it may easily be closed with a fit stopper of cork; and the lamp, filled with oil, may be carried about, in a carriage, with the greatest safety; and always be ready to be lighted when wanted, either in the carriage, or at inns on the road.

I have more than once carried one of these lamps in one of the pockets of my post-chaise, in travelling, and without ever having had reason to repent of the confidence I placed in its cleanliness, as I have already observed in another place.

It is hardly necessary that I should observe, that by means of a trifling alteration in the form of the secondary reservoir of this portable lamp, and the suppression of its foot, it may be made to serve perfectly well on the outside of carriages, instead of the lanterns now in use.

If it should be found to be necessary, a quantity of baked horse-hair, or of very fine brass wire, may be put into each of the reservoirs, in order to moderate the too violent concussion of the oil, in the sudden jolts of the carriage; or the same end may be attained, by dividing these reservoirs into a number of small compartments, by means of their vertical partitions of tin, having each two small holes of about one-tenth of an inch in diameter, the one on a level with the bottom of the reservoir, and the other on a level with the top of it. These partitions will not prevent the reservoirs from being filled with oil, and they will most effectually prevent the oil from being thrown out of the lamp, in consequence of the jolting and swinging motion of the carriage.

A hint is sufficient for English workmen, and their ingenuity and address are such, that they seldom fail to succeed in what they undertake.

By increasing the size of the portable lamp, in all its dimensions, it may, without any kind of difficulty, be made to contain oil enough to supply a burner on Argand's principles, of the full size; and by increasing the size of its screen, the handle of the lamp may be entirely concealed.

When constructed in this manner, its form becomes perfectly elegant, and such as will render it proper to be used as a table-lamp in the most elegant apartments.

Extracts from the 17th Essay on the same subject.

Many attempts have been made to increase the intensity of the light of lamps, in order to render them more useful in light-houses on the sea-coast, and for other purposes where a powerful light is wanted. The size of Argand's lamp has been increased, in the expectation that it might perhaps be made to give more light; but none of these attempts have succeeded.

In the year 1804, I contrived a method for illuminating large rooms by means of a single luminous balloon of gauze, of about 18 inches in diameter, suspended from the ceiling. In the centre of this balloon there are placed, as close together as possible, four, five, or six Argand lamps (according to the size of the room), which are supplied with oil from a large circular reservoir, which is concealed by the balloon. This invention has been found to answer very well, and many of the finest hotels in Paris are now lighted in this manner: but, if I am not much mistaken, this *illuminator* will soon give place to another, much more simple in its construction, more economical, and which must produce a much finer effect.

Since I have become better acquainted with the light which accompanies the combustion of inflammable substances, I have found means, by a very simple contrivance, to increase its intensity in a centre of illumination, almost without limitation.

I lately caused a lamp to be constructed, of a very simple form, which, with four flat or ribband wicks, each one inch and six-tenths English measure in width, placed vertically, one by the side of the other, at the distance of about two-tenths of an inch, and so separated as to let the air come up between them, gives more light than six Argand lamps burning with their usual brilliancy.

I have often measured the intensity of its light, and have never found it to be less than 3800°; and in several experiments, made in the presence of Professor Picet, and M. Micheli of Geneva, and of M. Charles, and M. Gay-Lusac, members of the Institute, it was found to give 4000° of light, equal to that of 40 wax-candles, of the best kind, all burning together with their greatest brilliancy.

But in an experiment made at my country house at Anteuil, on the 1st of November, 1811, in the presence of M. Russel, Chargè D'Affaires of the United States, (who takes this paper to England), the result was still more extraordinary.

Some little alterations having been made in the manner of trimming and arranging the lamp, it furnished no less than 5,250° of light, more than that of 52 wax-candles, and this without the least appearance of either smoke or smell.

On comparing the flame of an Argand lamp with the united flames of this new lamp, it appeared just as yellow and as dull as the flame of a common lamp appears, when compared with that of an Argand lamp.

It is indeed quite impossible to form an adequate idea of the beautiful whiteness and transcendent brightness of this new illuminator, without seeing it; and it never fails to excite the surprize and admiration of those who behold it for the first time.

The fundamental principle on which this lamp is constructed, is so easy to be understood, that it will be sufficient merely to mention it, in order to show clearly what must be done to put it in practice.

The object to be had in view, in all cases, is, *to preserve the heat of the flame as long as possible.*

One of the most simple methods of doing this is, no doubt, the placing of several flat flames together, and as near as possible to each other, without touching, in order that they may mutually cover and defend each other against the powerful cooling influence of the surrounding cold bodies.

It is evident, that this principle may be employed with great facility in all cases where oil is burnt to produce light; and that *polyflame* lamps of the smallest size, or of any given power of illumination, must necessarily be superior in effect, and be more economical, than any of the lamps now in use.

As a clear flame is perfectly transparent to the light of another flame which passes through it,* there is no danger of any loss of light, on account of these flames covering each other.

I caused the light of one flame to pass successively through eight other like flames, without being able to perceive the smallest diminution of its intensity.

A considerable advantage attending these new polyflame lamps is, that they do not

* See my paper on Light, published in the Philosophical Transactions in the year 1794.

require a narrow glass chimney, as a blower, to animate the combustion; it will be sufficient to cover their flames at a distance by a wide cylindrical glass tube, placed upright on a disk of glass, or metal, having apertures in the middle of it for the admission of the air, which must always be made to come up from below, between the flat tin tubes which contain the wicks.

This wide glass must be four or five inches higher than the level of the tops of the flames, and no air must be permitted to come up through it, but that which passes between the wicks, otherwise the draught of air between the wicks will not be sufficiently strong.

The flat tin tubes which contain the wicks, must be all inclosed together in a larger tube, (which may be either square or cylindrical,) in order that the air that comes up between these flat tubes may be confined in its passage, and brought properly into the fire.

Care must be taken, that the outside wicks, as well as those placed between them, receive air *on both their sides;* and this air must be made to rise up perpendicularly from below; but no other currents of air should ever be permitted to come near them, or enter the glass tube which covers and defends them.

It is highly probable, that it will be found to be very useful to regulate the quantity of air admitted; but this may easily be done by a variety of simple contrivances.

If more air be permitted to mix with the flame than is necessary to the complete combustion of oil, it must necessarily cool the flame, and consequently must diminish the quantity of light.

The lamp which I have in my possession being the only one of this kind that has yet been made, it is still in a rude and unfinished state; but as it has answered far beyond my most sanguine expectation, I lose no time in giving an account of the principles on which it is constructed, in hopes that others may be induced to assist in improving it.

So far from being jealous of their success, I shall rejoice in it, and shall ever be most ready to contribute to it by all the means in my power.

REVIEW OF NEW PUBLICATIONS.

Review of Wakefield's Statistical and Political Account of Ireland.

(Continued from page 315 of our last number.)

MR. WAKEFIELD, in the commencement of his work, has taken a sort of bird-eye or balloon prospect of the face of the country. But although there occur in this scenic sketch several just observations, yet the map is too crowded and contracted to give us any distinct ideas, and consequently any strong sensations; nor should we wish to estimate the merits of this author, by the specimens of his descriptive talents, or his powers of bringing before the *eyes of the reader* the beauties of rural scenery. This is indeed a rare talent, creative in a high degree; uniting the painter's eye with the poet's mind; requiring a distinctness of perception, a perfect command of language, a lucid arrangement of materials, and that judicious selection of the most impressive features in the general scenery, which makes the description what is called "Picturesque;" impressive as an actual painting, with the addition of poetic embellishment; the natural beauty receiving new graces from angelic mind hovering over it, and pouring down flowers and fruits from the cornucopia of a rich imagination.

Without observing such a talent as this, that can, by a stroke of the pen, imitate, and sometimes excel the best stroke of the pencil, we confess that we feel a great disinclination to encounter the perusal of these water-